

**The Nature of Syntactic Priming – Relevance and Interplay of
Semantic and Syntactic Information**

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Abstract

It is an ongoing matter of debate, what the nature of syntactic priming effects, and hence, the nature of grammatical information in language processing is. Two specific issues are the focus of the current examination: firstly, the possible relevance of semantic information, and secondly, the role of different stages in grammatical encoding (as proposed by Levelt, 1989). The results of two German picture-description experiments indicate that semantic information plays a weak role in syntactic priming and that, within the double object construction, the two possible word orders (NP1(dative)-NP2(accusative) and NP2(accusative)-NP1(dative) can be primed but do not prime each other. This can be interpreted as the lack of a priming effect on a functional or hierarchy-only level in grammatical encoding. In addition, the nature of word order priming is further investigated.

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1. The Psychological Reality of Syntax

The study of syntax is one of the core aims of linguistics; some would even say it was its primary aim. However, how psychologically plausible are theoretical syntactic accounts? Without any doubt, the mental generation and processing of language must be based on some kind of syntax – a system of structures and generalisations. Only an efficient system can solve the extremely complex task of dealing with the infinite and infinitely productive nature of human language. However, how similar is the syntax used by our brains to the syntax that is postulated by current syntactic theories?

One way to study this question is to use the experimental paradigm of syntactic or structural priming. This technique has been developed over the past 20 years and is currently among the most established psycholinguistic methods in the field of language production (e.g., Bock, 1986; Pickering & Branigan, 1998; Branigan, Pickering, & McLean, 2006). By making use of people's tendency to reuse structures that have previously been produced or comprehended, it is possible to investigate the nature of representations playing a role in the mental generation of language. In the case of syntactic priming, these representations are abstract, generalising over particular strings of words. The simple logic behind the whole idea is that anything that can be shown to be primable must be somehow psychologically real. By ruling out an influence of non-syntactic effects such as phonological or lexical priming, syntactic priming studies have strongly supported that mental representations of syntactic structures are real.

However, the actual nature of syntactic priming is still not really clear. Firstly, syntax is obviously not a simple one-dimensional level of information but subsumes various concepts and relations that are relevant to the structure of sentences (e.g., phrase structure, local dependencies, and grammatical functions). Secondly, it is worth asking whether there is really no non-syntactic, in particular semantic, information that comes into play. Speaking about semantic information opens another rather broad field of possible factors: Amongst others, conceptual features such as animacy and concreteness and semantic or thematic roles might interfere with syntactic processes.

In this work, I will investigate the role and interplay of syntactic and semantic information in syntactic priming and, hence, in language production. Firstly, I will examine whether there are any semantic effects in syntactic priming. Secondly, the exact nature of relevant syntactic information will be focussed on as a central topic, in particular the differentiation between different levels within grammatical encoding (functional and positional processing). I will present two syntactic priming experiments based on the picture-description and picture-sentence-match paradigm which make it possible to disentangle the influence of phrase structure and semantic information as well as to shed light on the stages of syntactic processing.

2. The Nature of Syntactic Priming

There is much and convincing evidence for the phenomenon of syntactic or structural priming (or persistence), defined as the tendency people have to repeat sentence structures that they have either produced or only comprehended before (e.g., Bock, 1986; Bock, 1989; Pickering & Branigan, 1998; Potter & Lombardi, 1998; Hartsuiker & Westenberg, 2000). This means that if there is more than one syntactic construction to express the same (or almost the same) meaning, it is also possible to strategically influence a speaker's choice, which variant he or she will use. Bock (1986), for instance, found that it is possible to bias participants' decisions about how to describe ditransitive events. There are two different possible ways to formulate a ditransitive sentence in English: with the double object construction (DO, such as in 1b) and with the prepositional object construction (PO, such as in 1a and 1c). DO and PO have different postverbal phrase structures – in a DO sentence, there are two nominal objects, in a PO sentence, there is one nominal object and one prepositional object.

- (1a) A rock star sold some cocaine to an undercover agent. (PO)
- (1b) The man is reading the boy a story. (DO)
- (1c) The man is reading a story to the boy. (PO) (Bock, 1986, p. 361)

Bock (1986) showed that after having repeated a prime sentence such as (1a), participants had a tendency to describe a picture with a sentence such as (1c) rather

than with a sentence such as (1b). In particular, they produced 23% more PO picture descriptions following PO prime sentences than following DO prime sentences and 22% more DO descriptions after DO primes than after PO primes.

However, syntactic priming could, in principle, be due to many different factors. It has hence become a matter of interest to find out whether any non-syntactic factors might be causing the priming effect and to specify the level of syntactic information which might play a role. Types of factors, that have been excluded from inducing the syntactic priming effect are, in a nutshell: lexical information (repetition of open-class words (in English nouns, verbs, adjectives, and adverbs): Pickering & Branigan, 1998; Cleland & Pickering, 2003; repetition of closed-class items (e.g., determiners and prepositions): Bock, 1986; Bock, 1989; Pickering, Branigan, & McLean, 2002)), phonology (prosody: Bock & Loebell, 1990; phonological relatedness: Cleland & Pickering, 2003), global sentence structure (e.g., matrix versus subordinate clause, Branigan et al., 2006), and detailed phrase-internal structure (e.g., the internal structure of a nominal phrase when the verbal phrase is the crucial local phrase, Pickering & Branigan, 1998).

Syntactic priming clearly differs from lexical and phonological priming: Neither the repetition nor the phonological resemblance of particular words between prime and target sentences is necessary to obtain an effect. Pickering and Branigan (1998) and Cleland and Pickering (2003) found that, although syntactic priming can be enhanced when the verb is repeated between prime and target sentences, there is still an effect if prime and target do not share any open class words.

As Pickering and Branigan (1998) and Branigan et al. (2006) showed, not everything that can be referred to as syntactic structure plays a role in syntactic priming. Syntactic information that has been shown to be relevant includes, firstly, *local phrase structure* or *local trees* (*phrase structure priming*, Pickering & Branigan, 1998; Branigan 2006), and secondly, word order (*word order priming*, Hartsuicker, Kolk, & Huiskamp, 1999; Hartsuiker & Westenberg, 2000).

Phrase structure, in general, refers to the structure of phrases that is specified for both precedence (i.e. how words and phrases are ordered in a sentence) and hierar-

chical relations (i.e. which phrases dominate over which other phrases in a structure tree). Local phrase structure refers to the configuration of only one mother node together with its daughter nodes. One can say, for instance, that DO and PO can be primed because they differ in a local tree: For DO, the daughter nodes of VP are V, NP, and NP (Figure 1a) and for PO, the daughter nodes of VP are V, NP, and PP (prepositional phrase) (Figure 1b).¹

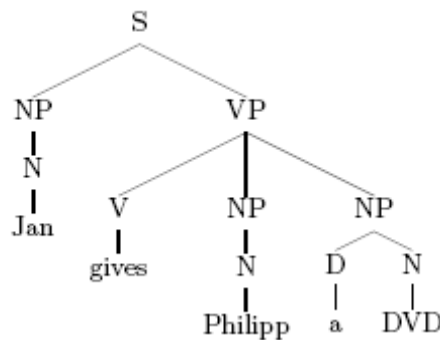


Figure 1a: DO Phrase Structure Trees

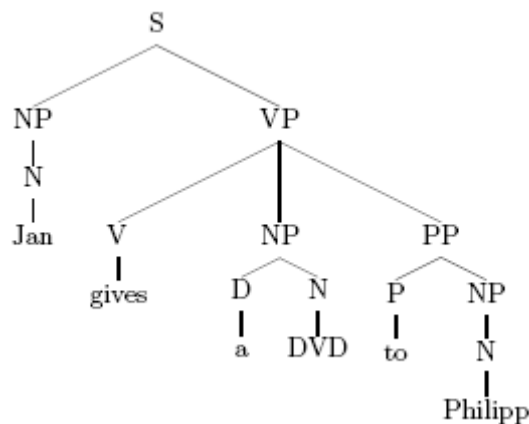


Figure 1b: PO Phrase Structure Trees

Word order, on the other hand, means the linear ordering of words or phrases in a sentence, independently of hierarchical relations or local trees. The expression word order priming, accordingly, refers to the priming of the order of words or phrases.

¹ For ditransitive sentences, I will generally consider the VP together with the verb and both its objects as one local tree, even though it is controversial how the internal structure of a ditransitive VP looks like and whether both objects are indeed sister nodes (see e.g. Larson 1988, 1990 for discussion).

However, there are still some controversial issues about what can actually be primed. Firstly, it is a matter of debate what role semantic information plays. Are phrase structure and word order priming completely independent of semantic information, such as information about the animacy of referents and information about the thematic roles of phrases? Secondly, it is unclear at which stages in *grammatical encoding* (Levelt 1989) syntactic priming can take place. In Levelt's language production model, the stage of grammatical encoding follows the conceptualisation of the utterance to be produced and precedes the phonological and phonetic encoding. Grammatical encoding is the level at which preverbal concepts (*messages*) are changed into actual linguistic structures. It is a common assumption that there are two stages within grammatical encoding, called functional and positional processing (Garrett, 1975; Bock & Levelt, 1994), at which different syntactic aspects are generated (e.g., the assignment of grammatical functions at the functional level and the specification of phrase structure at the positional level). Are there priming effects at both of these levels?

2.1 The Influence of Semantic Information

It is an interesting question whether in each single syntactic priming study all factors other than purely syntactic ones are controlled for at the same time. In a number of well-known experiments, different determinants are not actually disentangled (see Hare & Goldberg, 1999 and Salamoura & Williams, in press for discussion). For the two classic alternations used in syntactic priming studies, the dative alternation (e.g., Potter & Lombardi, 1998; Branigan, Pickering, & Cleland, 1999; Branigan, Pickering, & Cleland, 2000; Schoonbaert, Hartsuiker, & Pickering, 2007) and the active-passive alternation (e.g., Bock & Griffin, 2000; Loebell & Bock, 2003; Hartsuiker, Pickering, & Velkamp, 2004; Bock, Dell, Chang, & Onishi, 2007), the priming of phrase structure configurations and the priming of the order of thematic roles, for example, would give rise to the same results.

In active sentences, the subject is usually an *AGENT* (someone who is doing something actively) and the object a *PATIENT* (a person to whom or a thing to which something is done) (2a), whereas in passive sentences, the subject is a *PATIENT* and the *AGENT* is expressed via an oblique prepositional phrase (2b). In English active

sentences then, the AGENT always precedes the PATIENT and in English passive sentences, the PATIENT always precedes the AGENT. Moreover, active and passive sentences differ in phrase structure (2a: NP-V-NP; 2b: NP-AUX (auxiliary)-V-PP).

- (2a) Tim called the builder.
- (2b) The builder was called by Tim.

In a DO-ditransitive sentence, the first object is usually a *RECIPIENT* (someone who receives something) and the second object is a *THEME* (something that is given) (3a), whereas in a PO-ditransitive sentence, the *THEME* precedes the *RECIPIENT* (3b). Again, the phrase structure is also different (3a: NP-V-NP-NP; 3b: NP-V-NP-PP).

- (3a) Tommy gives his flatmates five bottles of beer.
- (3b) Tommy gives five bottles of beer to his flatmates.

In some other experiments, which do not use these two alternations, the effects cannot straightforwardly be ascribed to thematic roles but other semantic effects cannot be completely excluded. Cleland and Pickering (2003), for example, showed that the choice between modifying a noun with an adjective or with a relative clause can be primed. Neither adjectives nor relative clauses can be said to bear thematic roles nor do they have conceptual features such as animate versus inanimate. However, it is not impossible that the order of broader semantic concepts, such as modifier-entity versus entity-modifier was primed.

In general, there are different opinions about the role that semantic and thematic information plays (Bock & Loebell, 1990; Bock, Loebell, & Morey, 1992; Lombardi & Potter, 1992; Hare & Goldberg, 1999; Heydel & Murray, 1997, 1998, 2000; Chang, Bock, & Goldberg, 2003; Chang, Dell, & Bock, 2006; Griffin & Weinstein-Tull, 2003; Salamoura & Williams, in press).

Bock and Loebell (1990) became aware of the problem that syntactic priming effects could be influenced by thematic information. They conducted two experiments with the sentence recall paradigm serving as the prime task and picture descriptions as

the target task. In the first experiment, they compared the effects of ditransitive prime sentences with a PP such as (4a) and prime sentences containing a locative PP (4b) on the description of pictures showing ditransitive events.

(4a) The wealthy widow gave her Mercedes to the church.

(4b) The wealthy widow drove her Mercedes to the church.

Both sentences have the same phrase structure (NP – V – NP – PP) but, in Bock and Loebell's opinion, a different thematic structure: In (4a) the PP contains a NP that denotes a RECIPIENT, in (4b) the NP within the PP refers to a GOAL. The experimental pictures, for example with a man giving a ball to a boy, could either be described with a DO sentence such as (5a) or a PO sentence such as (5b).

(5a) The man gives the boy the ball.

(5b) The man gives the ball to the boy.

(5b) has the same phrase structure as both (4a) and (4b) but shares the thematic structure with (4a) only. Bock and Loebell's results showed that both types of primes (like 4a and 4b) significantly increased the use of the PO construction type (such as 5b) compared to DO primes. They conclude that phrase structure but not thematic structure is relevant for syntactic priming.

In the second experiment, the prime sentences contained *by*-PPs, with NP complements either referring to an AGENT (6a) or to a LOCATION (6b):

(6a) The 747 was alerted by the control tower.

(6b) The 747 was landing by the control tower.

As in experiment 1, the phrase structure of both prime types was the same (at least superficially, see next paragraph) but the thematic structure differed. The experimental pictures showed transitive situations, describable with active and passive sentences. There was a significant priming effect: Participants produced more passive sentences after both prime types compared to the active primes, indicating, again, that phrase structure is primable independently of thematic structure. Interestingly, Bock

and Loebell (1990) did not find an enhancement of the priming effect when both phrase structure and thematic structure were repeated – both prime types in each experiment showed equally strong effects. The authors conclude, therefore, that thematic structure is irrelevant to syntactic priming.

Potter and Lombardi (1998), in contrast, found a difference between locative and PO primes: Locatives primed POs significantly less than PO primes did. However, they suggest that this difference between Bock and Loebell's (1990) results and their own might be due not to different thematic roles but to different proportions of animate and inanimate referents in the PO and the locative sentences: In Potter and Lombardi's study, there were more animate PPs in PO sentences and fewer animate PPs in locatives than in Bock and Loebell's study. That means that it is possible that, in Potter and Lombardi's experiment, POs were primed better by POs than by locatives because there was a match in animacy between the PO primes and the target but not between the locative primes and the target. If this explanation is correct, this would indicate a relevance of animacy for syntactic priming.

There are some problems with Bock and Loebell's (1990) study. Firstly, as discussed by Hare and Goldberg (1999), their first experiment does not really rule out an influence of thematic structure since the roles RECIPIENT and LOCATION are not very different from each other and are often subsumed under the broader concept of GOAL. Secondly, it is unclear whether the priming effect in the second experiment could not be due to the repetition of the preposition *by*. It has been shown in another experiment that successful priming was not caused by the repetition of closed-class words (Bock, 1989; Pickering et al., 2002). However, in this particular design, a potential confound with this lexical effect was arguably not controlled for. It would be necessary to test locative sentences with prepositions other than *by* to resolve this uncertainty. In sum, the evidence against an influence of thematic information coming from this study is not totally convincing.

Evidence for an influence of semantics on syntactic priming can be seen in studies by Hare and Goldberg (1999), Heydel and Murray (1997, 2000), Chang, Bock, and Goldberg (2003), and Salamoura and Williams (in press). Hare and Goldberg (1999) conducted a modified version of Bock and Loebell's (1990) study. They added

a baseline condition (intransitive sentences) as well as prime sentences of the *provide-with* type such as (7):

- (7) His editor credited Bob with the hot story. (Hare & Goldberg, 1999, p. 3)

Verbs like *provide* and *credit* require an interesting construction – an NP referring to a GOAL and a *with*-PP containing an NP which denotes a THEME. Therefore, the phrase structure is the same as in the PO construction but the thematic structure (the order of thematic roles) equals that of the DO construction. Hare and Goldberg (1999) found that significantly more DO sentences were produced following DO primes and provide-with primes in comparison to PO primes. This indicates that the thematic structure (or the order of animate and inanimate referents denoted by the NPs) rather than the phrase structure was reused. However, it is problematic that each participant saw only one of the four prime types (PO, DO, provide-with, or baseline) in the experiment because individual differences of the participants might have contributed to the differences in their choice of construction.

However, Salamoura and Williams (in press) found a similar priming effect in a cross-language oral sentence completion priming study. Cross-language syntactic priming studies make it possible to investigate whether and how syntactic representations between two languages are shared (e.g., Loebell & Bock 2003, Meijer & Fox Tree 2003, Hartsuiker, Pickering, & Velkamp 2004, Desmet & Declercq 2006). Moreover, they broaden the variety of phenomena that can be tested and increase the plausibility of attributing the observed effects to abstract syntactic structures because lexical items differ between languages.

In Salamoura and Williams' (in press) study, Greek was the participants' first language and English their second language. In their third experiment, Salamoura and Williams used four different prime conditions (all in Greek): DO sentence fragments (8a), PO sentence fragments (8b), locative sentence fragments (8c), and provide-with sentence fragments (8d). The locative primes were sentences with PPs containing NPs that denoted real static locations rather than goals like in Bock and Loebell (1990). The target fragments (such as 8e) were all in English and could be completed with either an NP or a PP, resulting in a DO or PO sentence.

- (8a) *Ο ικανοποιημένος διευθυντής πρόσφερε του υπαλλήλου του...*
'The happy director offered his employee...'
- (8b) *Ο ικανοποιημένος διευθυντής πρόσφερε του ένα δώρο...*
'The happy director offered a present...'
- (8c) *Ο ικανοποιημένος διευθυντής άφησε ένα δώρο πάνω...*
'The happy director left a present on...'
- (8d) *Ο ικανοποιημένος διευθυντής ανταμείψε τον υπάλληλό του με...*
'The happy director rewarded his employee with...'
- (8e) The clown gave... (Salamoura & Williams, in press, p. 39)

The results show that provide-with primes behaved like DO rather than PO primes, which supports Hare and Goldberg's (1999) findings. Moreover, the locative primes increased the use of PO sentences. Additionally, Salamoura and Williams found in their second experiment that POshifted primes (PP before NP) did not increase the use of DO targets.

On the one hand, the priming between provide-with and DO shows that the thematic structure (NP1 = RECIPIENT / animate, NP2 = THEME / inanimate) can be primed despite the absence of a match in phrase structure (NP-PP vs. NP-NP). On the other hand, the lack of an effect of the POshifted primes on DO targets indicates that thematic structure cannot always be primed when the phrase structure is different (PP-NP did not prime NP-NP even though the thematic structure was equal). Phrase structure cannot always be primed without a match in thematic structure either as the finding that provide-with sentences did not increase the use of PO shows. Locatives, however, did prime POs although the PPs bore different thematic roles in the two conditions (the PP in PO is a GOAL, the PP in a static locative a LOCATION). Salamoura and Williams' solution to the pattern of these findings is the *first argument pairing hypothesis*: It is the syntactic structure together with the thematic structure that is primed but only the first postverbal argument is crucial. That means that syntactic priming only takes place when the first postverbal phrases (which are, in fact, not the first arguments but the second) of prime and target sentences share both the phrase type and the thematic role.

This theory indeed captures Salamoura and Williams' findings quite nicely – however, it seems a bit arbitrary that different layers of only one position should be crucial in language production. More generally, it is unclear whether syntactic priming is influenced by particular (syntactic and semantic) information bound to particular positions (either in a kind of surface structure or at a deeper level) or if the crucial point is linear (or precedence) relations or dependencies. To make something like the first postverbal argument the determining part it also quite unsatisfactory from a cross-linguistic point of view – obviously this theory is constrained to languages with SVO word order.

Both provide-with studies show very interesting results – that the order of semantic information (animacy or thematic roles) or the assignment of semantic information to certain positions can be primed independently of phrase structure. As Hare and Goldberg (1999) mention, however, the effect of thematic structure and the effect of the order of animate versus inanimate referents denoted by the phrases are not disentangled in this design. This means that provide-with studies do not tell us which of both effects is actually relevant.

Bock, Loebell, and Morey's (1992) study indicates that it is conceptual information such as animacy rather than thematic structure that has an influence on syntactic processing. They conducted priming experiments with the active-passive paradigm in which the animacy of AGENT and PATIENT was systematically manipulated. In addition to a general priming effect (more actives after active primes and more passives after passive primes), the authors found an effect of animacy match: Both prime sentence types (9a) and (9b) elicited the active form of the target (9c), rather than the passive one (9d).

- (9a) The boat carried five people.
- (9b) The boat was carried by five people.
- (9c) The alarm clock awakened the boy.
- (9d) The boy was awakened by the alarm clock.

This supports the hypothesis that there is a direct mapping between the subject and object positions and conceptual features such as animacy and that people tend to

repeat specific associations or bindings between these two structures (e.g., inanimate-subject). Bock et al.'s (1992) results indicate that the animacy of referents is crucial in generating sentences and that it can be primed which position is linked to the phrase denoting an inanimate entity. This also fits with Potter and Lombardi's (1998) finding that an animacy match between prime and target enhanced phrase structure priming. There is also some other evidence that animacy is an important factor in language production in general: Animacy belongs to the features that determine an entity's conceptual accessibility (Tanaka 2006, Branigan, Pickering, & Tanaka in press). The conceptual accessibility of entities in turn influences the position of their linguistic realization in a sentence to be produced (either via grammatical function assignment or via linearization or both). It is not really straightforward how to apply the first argument hypothesis to Bock et al.'s results because in an English passive sentence, there is no postverbal argument at all (only an adjunct).

In order to find out whether thematic roles have an influence on syntactic priming independently of animacy, Chang et al. (2003) used another kind of construction: verbs of the *spray-load alternation* type. There are two possible argument-structures for these verbs, either NP(AGENT)-NP(THEME)-PP(LOCATION) (10a) or NP(AGENT)-NP(LOCATION)-PP(THEME) (10b).

(10a) The chef sprayed oil onto the pan.

(10b) The chef sprayed the pan with oil.

In Chang et al.'s study, sentences were presented on a screen and participants were asked to repeat them. The essential question was whether there is a tendency to repeat a sentence like (10a) in the wrong way (like 10b) when it followed the repetition of a sentence like (10b) and vice versa. In fact, participants produced the LOCATION-THEME construction significantly more frequently after a LOCATION-THEME prime than after a THEME-LOCATION prime. The authors conclude that the order of thematic roles can be primed independently of phrase structure and, importantly, the order of animate and inanimate referents denoted by the phrases. These results would fit into the first argument hypothesis: The priming effect was independent of phrase structure but the phrase structure was the same between primes and targets (other than with the POshifted prime).

Moreover, Chang et al. found in a second experiment that PO primes caused the same priming effect as transitive sentences with a PP that contained an NP which denoted a *BENEFICIARY* (someone to whom something positive is done). They interpret this as supporting Bock and Loebell's (1990) theory that phrase structure can be primed independently from thematic structure, resulting in a model in which both phrase structure and thematic structure can be primed independently of each other. However, this finding could also be explained by the first argument pairing hypothesis: In both prime types, the first postverbal argument is an NP and a THEME or PATIENT (it is a matter of debate how much these roles differ).

There might be one problem with Chang et al.'s study: The priming effect could be due to the repetition of prepositions. Firstly, the preposition of the LOCATION-THEME primes and targets was always *with*. Secondly, the preposition in the THEME-LOCATION primes and targets was 'onto' or 'into' in 25 out of 32 sentences (four times 'on', one time around, 2 times over). This means most often when participants repeated the thematic structure of the prime, they also used the same preposition. Moreover, as Chang et al. mention themselves, conceptual features other than animacy such as concreteness could be relevant for the priming as well.

Another investigation on the role of semantic, in particular conceptual, information on syntactic priming has been done by Heydel and Murray (1997, 1998), summarised in Heydel and Murray's (2000) article. Their experiments were based on a combination of a sentence-picture-match task and a picture-description task. Participants were asked to read a German sentence (prime) and then to decide whether two particular pictures, that were presented to them simultaneously, matched the sentence. Additionally, both pictures had to be described in English (target). There were three prime conditions, active (11a), topicalisation (11b), and passive (11c):

- (11a) Ein PR-Mann berät den
 a.masc.sg.nom PR-man.masc.sg.nom advises the.masc.sg.acc

 Manager
 manager.masc.sg.acc
 'A PR-man advises the manager.'

- (11b) Den Manager berät ein
 the.masc.sg.acc manager.masc.sg.acc advises a.masc.sg.nom

PR-Mann

PR-man.masc.sg.nom

‘A PR-man advises the manager.’

- (11c) Der Manager wird von einem
 the.masc.sg.nom manager.masc.sg.nom is by a.masc.sg.dat

PR-Mann beraten.

PR.man.masc.sg.dat advised

‘The manager is advised by a PR-man.’

Interestingly, the topicalised prime type (NP-V-NP) increased the use of the passive (NP-AUX-PP-V) by 11.5% (rather than the use of the active (NP-V-NP)). This was an even higher increase of passive sentences than the one caused by passive primes (8.7%). The authors reflect that this shows that it is the order of conceptual information that is relevant, not (or not only) the sentence structure – in both topicalised sentences and passive sentences, the PATIENT precedes the AGENT, or, in other words, the PATIENT is highlighted in both constructions. This effect cannot be explained by animacy effects – both AGENTS and PATIENTs were animate. However, the authors assume that it is not the order of thematic roles per se that is primed but which role is *focused* (of the many different meanings that have been assigned to the word ‘focus’, they seem to mean something like ‘emphasis, highlighting’). Therefore, Heydel and Murray (2000) localise the effect in the message or conceptualisation level.

To sum up the discussion so far, it is unclear whether conceptual information (such as animacy) or thematic structure or both play a role in syntactic priming. It seems likely that something semantic is relevant in syntactic priming – the strongest evidence for that are the findings of provide-with studies. The results of Bock et al. (1992) and Potter and Lombardi (1998) indicate that it might be animacy that is crucial. However, there is no a priori reason why phrase structure and semantic structure

(of whichever kind) should not both be psychologically relevant (although the evidence for the independence of phrase structure is not completely convincing, see the discussion about Bock and Loebell, 1990).

It is also possible that semantic information other than animacy and thematic roles plays a role. Moreover, both semantic or more semantic-syntactic information could be relevant. There is one type of categorisation system, for instance, in which there are five semantic-syntactic categories: S (the only argument in an intransitive sentence), A (that is the agent-like or subject-like argument in a transitive sentence), O/P (patient-like or object-like argument in a transitive sentence), T (theme-like argument in a ditransitive sentence), and R (recipient-like argument in a ditransitive sentence) (Dixon, 1972, 1979). These classes are, firstly, broader than thematic roles and, secondly, not purely semantic. They are, like thematic roles, between grammatical functions (which provide purely syntactic information) and atomic semantic features like animacy (which provide purely semantic information), but are a bit more grammatical than thematic roles.

Finally, of course the fact that pragmatic factors might play a role in syntactic priming studies as well must be taken into account, at least in experiments based on the active-passive paradigm. Heydel and Murray (2000) suggest that the crucial difference between actives and passives is the shift of emphasis. The choice between the double object construction and the prepositional object construction is less constrained by focus – however, it is partly determined by information structure (or discourse accessibility) (e.g., Bresnan, Cueni, Nikitina, and Baayen 2004). In general, it seems reasonable to look for the different distributions of alternating constructions (by examining authentic language data) when investigating the nature of syntactic priming. The motivations to choose one construction type or the other (e.g., ordering constraints like animate-before-inanimate) should provide a good starting point to answer the question what exactly it is that is primed. At the very least, these findings from corpus studies can help to choose factors that can then be tested experimentally. I will come back to this in the general discussion.

2.2 Primable Levels in Grammatical Encoding

Another controversial issue in the discussion of the nature of syntactic priming is at which levels in grammatical encoding priming effects can be located. Following Garrett (1975), Bock and Levelt (1994) and others, there are two stages in grammatical encoding, functional and positional processing. Functional processing refers to the selection of lemmas and the assignment of grammatical functions. During positional processing the phrase structure is built (and inflections are aligned). In principle, there should be observable priming effects at each stage that is relevant to language production. This means that priming should take place with regard to grammatical functions as well as with regard to phrase structure. Additionally, it has been discussed whether phrase structure can be further subdivided into hierarchical (or dominance) relations and linearization (or precedence) (Pickering et al. 2002). If this is true, both hierarchical relations and word order should be primable independently of one another. Alternatively, it has been suggested that the assignment of grammatical functions together with the determination of hierarchy relations precedes the word order or linearization specification (Kempen & Hoenkamp, 1987; Hartsuiker & Westenberg, 2000).

Hartsuiker and Westenberg (2000) examined the plausibility of these different stages. They conducted a study in Dutch with sentence repetitions as primes and picture descriptions as targets. Participants were asked to indicate after each item whether they had seen it before or not. There were both transitive prime-target pairs (actives, passives of type one (P1), and passives of type two (P2)) and ditransitive prime-target pairs (DO, PO, and POshifted). In P2 sentences, the by-phrase preceded the lexical verb (e.g., *De sloot wordt door de boer vervuild*. ‘The drain is by the farmer polluted.’). In POshifted, the PP preceded the object NP (e.g., *De zeeman schrijft aan zijn vriendin een lange brief*. ‘The sailor writes to his girlfriend a long letter.’).

The results for the transitive sentences were not entirely conclusive – there was no priming effect for actives at all and priming effects for P1 in one of three experiments only. However, there was an important result in the first experiment – P2 sentences significantly increased the number of P2 descriptions but not the number of P1 descriptions. With regard to the ditransitive sentences the outcomes were clearer:

DOs primed DOs, POs primed POs, and POshifted primed POshifted. PO and POshifted showed no effects as primes for each other although they neither differ with regard to functional relations (the NP is assigned the function of the direct object and the PP is assigned to the indirect object in both cases) nor in terms of hierarchy (at least in a theory without movement). The authors conclude that it is possible that priming at the functional level has taken place but was overruled by word order priming.

Pickering et al. (2002) examined the priming interplay of PO and POshifted in English. They discuss the plausibility of two possible models of positional processing: the single-stage model (Figure 2) and the dominance-only account (Figure 3). In the single-stage account, there is only one processing level of constituent structure with specifications for hierarchy and precedence at the same time. In the dominance-only model, a stage of hierarchy only precedes the decision about precedence.

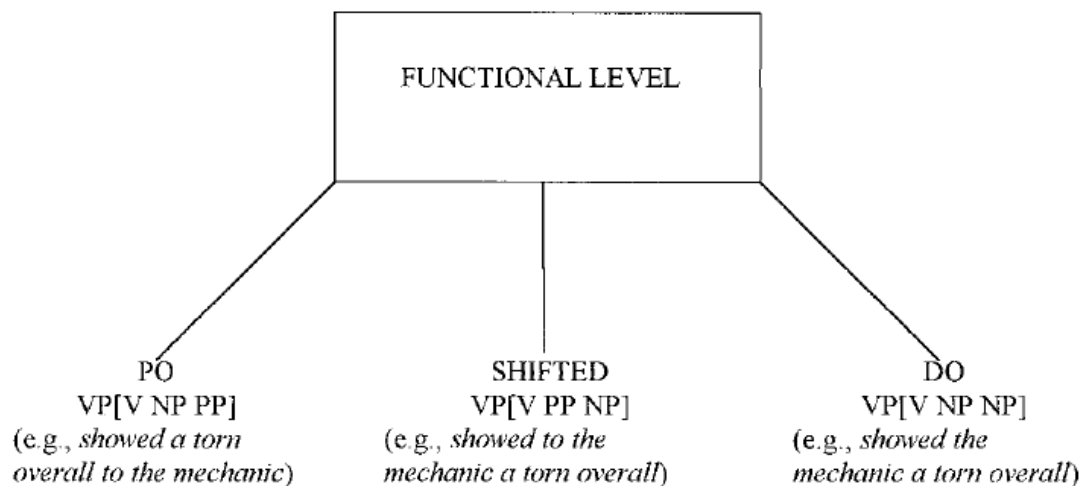


Figure 2: Single-stage model (Pickering et al., 2002, p. 590)

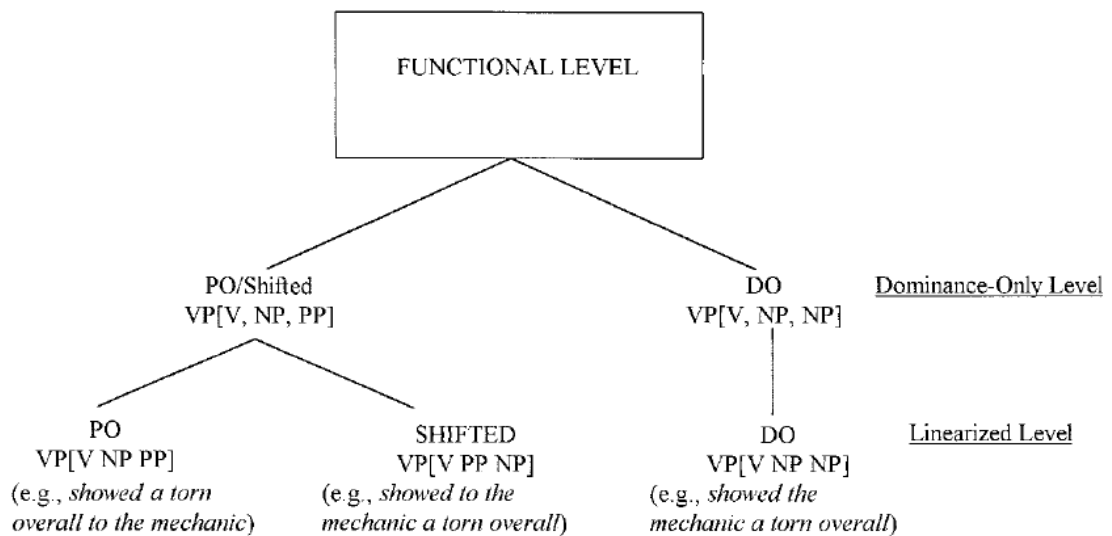


Figure 3: Dominance-only model (Pickering et al., 2002, p. 590)

In Pickering et al.'s sentence completion study, POshifted inducing prime sentence fragments such as (12) were used, additionally to DO and PO inducing fragments:

(12) The youngster showed to the teacher... (Pickering et al., 2002, p. 603)

In experiments 2, 3, and 4, the authors found that POshifted and PO did not prime each other, in accordance with Hartsuiker and Kolk's results. POshifted rather patterned with the intransitive baseline prime with regard to PO targets. Since both constructions share their hierarchical relations and differ in word order only, the authors conclude that a level of dominance-only cannot be supported.

Hartsuiker and Kolk's and Pickering et al.'s studies show the same kind of results. It could be that there is neither priming at the level of functional processing (either with or without hierarchy specification) (Hartsuiker and Kolk) nor at a possible hierarchy-only level (Pickering et al.), or, alternatively, the effects cannot actually emerge or become visible as word order (or phrase structure) priming works against it.

A more recent contribution to this debate comes from Bernolet, Hartsuiker, and Pickering (in preparation). They conducted priming experiments with the two

passive structures of the type used in Hartsuiker and Kolk (1998) in Dutch and between Dutch (prime) and English (target). Their results for the within-Dutch experiments pattern with Hartsuiker and Kolk's (1998) and Pickering et al.'s (2002) findings: Although both P1 and P2 could be primed, they did not prime each other. However, interestingly, Dutch P2 primes significantly increased the use of passives in English compared to active primes (21.2%). The authors reason that this pattern of effects supports the theory that priming at the functional level occurs (that is why P2 primed English passives) but can be overruled by word order priming – as in the within Dutch experiments. However, other explanations for the between-language effect are possible which do not have to do with the *association* between phrases or event roles and functions. Instead, different kinds of mere *order effects* could be crucial – such as AGENT before PATIENT (mentioned by the authors as well) or object before subject. Another possibility is that a more general effect of voice comes into play like the highlighting of the PATIENT discussed above.

To sum up the above discussion, the only level in sentence generation that clearly seems to be primable is the positional level as a whole - either linearization alone or linearization and dominance information. The former is supported by Hartsuiker, Kolk and Huiskamp (1999) and Hartsuiker and Westenberg (2000). Their studies show that the linearization of the VP and an adjunctive PP (VP-PP vs. PP-VP) as well as the order of auxiliary and verb (V-AUX vs. AUX-V) is primable (see also Vigliocco & Nicol, 1998).

Hartsuiker and Westenberg (2000) argue that the priming effect in their study must be due to a separate level of linearization rather than a level of hierarchy together with linearization. They believe that priming can take place at the conceptual level, the functional level, and the linearization level. They argue that the assignment of grammatical functions specifies a choice between PO and DO already (e.g., if the THEME is assigned the function of the direct object and the RECIPIENT is assigned the function of the prepositional object, only PO is possible). It is true that once the grammatical functions are specified, the construction type is determined as well. However, it is not clear that the assignment of grammatical functions is primable. In any case, it cannot be concluded from Hartsuiker and Westenberg's findings that the primed information is free from hierarchy specifications.

Hartsuiker and colleagues do not define explicitly what exactly they mean by ‘word order priming’. Obviously, the critical elements are not the words themselves, because that would be a lexical effect. The priming of the order of verb and auxiliary cannot be due to the order of phrases, either, because verb and auxiliary are contained within the same phrase. As Hartsuiker and Westenberg (2000) mention, verb and auxiliary do not bear conceptual information and grammatical functions, either.

A plausible explanation for this study is that the order of parts of speech was primed. In principle, a dependency relation could be crucial as well. It might also be the case that morphosyntactic or phonological effects have played a role: All verbs that were elicited in the prime and target fragments were participles, which all share the same prefix in Dutch (*ge-*). It would be interesting to test whether the same priming effect can be obtained with a mixture of participles and infinitives (which are not marked with this prefix). With regard to the priming of the order of VP and adjunct PP, it is possible, as mentioned by Hartsuiker and Westenberg (2000), that conceptual factors play a role (the two different word orders cause differences in pragmatics). I will come back to the psychological reality of word order again later.

The preceding discussion shows that the evidence for word order priming is not perfect. In general, linearization cannot be the only process that is primable - the production of DO and PO, for example cannot be explained by the choice between alternative word orders alone. The priming process that is needed in addition to word order priming could be grammatical function assignment or something like local tree configuration or construction type (or both).

3. Experiment 1

In the first experiment of the present investigation, the relevance of phrase structure and semantic structure (thematic roles or animacy) in syntactic priming was examined. The experiment was conducted in German because German provides a greater freedom of word order than English does, and this was crucial to the design: Within the DO construction, both RECIPIENT(animate)-THEME(inanimate) (DO, 13a) and THEME(inanimate)-RECIPIENT(animate) (DOshifted, 13b) are grammati-

cal orders. Because the PO construction is possible for alternating ditransitive verbs as well, there are three ways of expressing a ditransitive event (in theory, a fourth word order, POshifted, is possible, as well. However, I will ignore it because it is extremely rare).

- (13a) *Er schickt der Tante*
 he.nom sends the.fem.sg.dat aunt.fem.sg.dat

die Karte.
 the.fem.sg.acc postcard.fem.sg.acc
 ‘He sends the aunt the postcard.’

- (13b) *Er schickt die Karte*
 he.nom sends the.fem.sg.acc postcard.fem.sg.acc

der Tante.
 the.fem.sg.dat aunt.fem.sg.dat
 ‘He sends the aunt the postcard.’

This makes it possible to disentangle thematic and phrase structure effects: PO and DOshifted share their order of thematic roles (AGENT-THEME-RECIPIENT) but not their phrase structures (10a: NP-V-NP-PP, 10b: NP-V-NP-NP). If the thematic structure of a sentence plays a role which is independent of phrase structure (Chang et al., 2003; Hare & Goldberg, 1999; Salamoura & Williams, in press), it should be expected that PO primes induce DOshifted targets. If this is the case, it is also interesting whether the priming effect is equal to or weaker than the priming effect of DOshifted primes for DOshifted targets.

Moreover, in this experiment, it can be tested whether DO primes increase the use of DOshifted targets and whether DOshifted primes increase the use of DO targets (i.e. whether DO and DOshifted prime each other). DO and DOshifted are equal with regard to two characteristics (like P1 and P2 (Hartsuiker & Kolk, 1998; Bernolet et al., in preparation) and PO and POshifted (Pickering et al., 2002)). Firstly (at least in an account that does not involve movement), they share their hierarchy relations: The

phrase structure trees of both DO and DOshifted contain the same nodes and the nodes in both trees stand in the same relationships to each other; only the order of nodes differs. Secondly, the assignment of grammatical functions is the same for both DO and DOshifted: The nominal phrases are assigned the same functions (NPdat > indirect object, NPacc > direct object). To conclude, DO and DOshifted could prime each other because they are equal in two ways, on the functional level, and on a hierarchy-only level. If they do not prime each other, that can be taken as evidence against the hypothesis that priming on a functional and hierarchical level occurs. Finally, a null effect (no priming between DO and DOshifted) would show that there must be a psychologically real difference between DO and DOshifted, that has nothing to do with the combination of phrase types: The syntactic categories of DO and DOshifted are absolutely equal (NP-V-NP-NP).

The predictions for the results of the first experiment are as follows. Firstly, PO prime sentences will increase the use of DOshifted responses because of priming of the order of thematic roles or of the order of the animate and the inanimate object. As the provide-with studies indicate (Hare & Goldberg, 1999; Salamoura & Williams, in press), it seems to be possible to prime semantic structure independently of phrase structure. Secondly, DO sentences will prime DO descriptions and DOshifted sentences will prime DOshifted descriptions. It has been shown that word order priming is possible (Hartsuicker, Kolk, & Huiskamp, 1999; Hartsuiker & Westenberg, 2000). Thirdly, DO sentences and DOshifted sentences will not prime each other either because no functional or hierarchy-only priming takes place or because word order priming works against functional or hierarchy-only priming (Hartsuiker & Westenberg, 2000; Pickering et al., 2002, Bernolet et al., in preparation).

3.1 Methods

3.1.1 Participants.

24 native speakers of German (8 males, 16 females) with an average age of 28.83 years (20 to 53) were tested. Some of them were students and some professionals from various fields. The experiment took place at the University of Edinburgh and participants were paid £4.

3.1.2 Materials.

For the presentation of the prime sentences, the sentence-picture-match task was used. The picture description paradigm served as the target task. There were four prime conditions: ditransitive sentences with the nominal dative object preceding the nominal accusative object (DO, 14a), ditransitive sentences with the nominal accusative object preceding the nominal dative object (DOshifted, 14b), ditransitive sentences with the nominal accusative object preceding the prepositional object (PO, 14c), and intransitive baseline sentences (base, 14d).

- (14a) Die Kellnerin übergibt
the.fem.sg.nom waitress.fem.sg.nom gives

dem Clown die Tasse
the.masc.sg.dat clown.masc.sg.dat the.fem.sg.acc cup.fem.sg.acc
‘The waitress gives the clown the cup.’
- (14b) Die Kellnerin übergibt
the.fem.sg.nom waitress.fem.sg.nom gives

die Tasse dem Clown.
the.fem.sg.acc cup.fem.sg.acc the.masc.sg.dat clown.masc.sg.dat
‘The waitress gives the clown the cup.’
- (14c) Die Kellnerin übergibt die
the.fem.sg.nom waitress.fem.sg.nom gives the.fem.sg.acc

Tasse an den Clown.
cup.fem.sg.acc to the.masc.sg.acc clown.masc.sg.acc
‘The waitress gives the cup to the Clown.’
- (14d) Die Kellnerin klatscht.
the.fem.sg.nom waitress.fem.sg.nom claps
‘The waitress claps.’

The targets were simple black-and-white line drawings illustrating ditransitive (experimental trials) and transitive events (filler trials). Figure 4 shows one of the experimental pictures. Below the pictures, the infinitives of the verbs to be used were shown. These verbs all belonged to the non-alternating class of ditransitive verbs; thus the DO and DOshifted constructions were possible, but not PO. This design was chosen to increase the likelihood that DOshifted descriptions were elicited following PO primes and to reduce the number of possible outcomes.

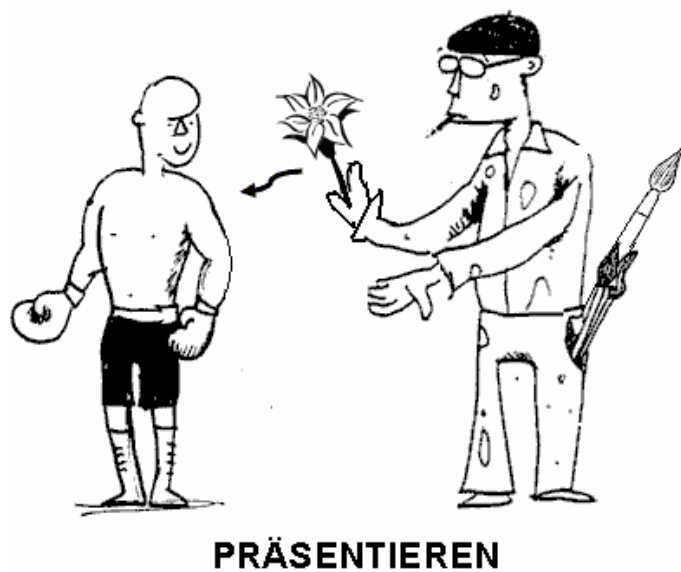


Figure 4: Example target picture with the verb *präsentieren* ('to present')

There were 24 prime items (sentence-picture pairs) in each of the four conditions and 24 target pictures. The items were placed into four lists; on each list there were six items from each condition and every item appeared in only one condition. Each of the target and prime verbs was used twice. No verb, object, or character was repeated within a prime-target pair. Additionally, 72 fillers were used, half of which were picture-sentence pairs (match task) and half of which were pictures with verbs (description task). The filler verbs (on the cards and in the prime sentences) were all transitive and the objects were counterbalanced for animacy. 50% of the sentence-picture-prime-pairs and 50% of the sentence-picture-filler-pairs matched, 50% of each did not match. Moreover, the mismatches were counterbalanced for the type of mismatch (AGENT mismatch, RECIPIENT mismatch, and THEME mismatch). The order of the characters on all pictures was counterbalanced, too. The order of presenta-

tion of the experimental and filler items was randomised (except that each target was immediately preceded by a prime and that at least two fillers intervened between experimental trials) such that no two participants saw the items in the same order. All experimental sentences are listed in Appendix A.

3.1.3 Procedure.

Participants were tested individually in a quiet room. They were asked to sit at a desk in front of a computer screen. First, an introduction was shown on the screen, explaining what the participants had to do: For the sentence-picture match task, a sentence was shown in the middle of the screen and participants were asked to read it silently and to push the space button after they had read it. Then a picture appeared in the middle of the screen and the participants' task was to decide whether the sentence and the picture matched each other or not (by pressing 'N' for *no* and 'Z' for *yes*). For the picture description, a picture with a verb appeared in the middle of the screen and had to be described aloud (using the correct conjugated form of the verb). After the picture description, the next trial was started by pressing the space bar. In the experimental conditions, each match task was immediately followed by a description task. For the picture-sentence match task, the background was white and for the description task, the background was blue. The stimuli were presented using E-Studio software. The whole experiment was self-paced but participants were encouraged to make decisions and describe pictures as spontaneously as possible.

After the introduction, there was a short practice session to familiarise participants with the tasks. Participants had the chance to ask questions for clarification and were given feedback during and after the introduction and practice session. Afterwards, the experimenter left the room and no further feedback was provided. When the participants had finished the experiment, they were asked to complete a short demographical questionnaire. The experiment took no longer than 25 minutes including instructions, practice session, and filling out the questionnaire.

3.1.4 Scoring, design, and data analysis.

The experiment was recorded on audio tape. The sentences produced in the experimental target picture description were coded in terms of syntactic structure, using three categories: DO (V – NP(RECIPIENT) – NP(THEME)), DOshifted (V –

NP(THEME) – NP(RECIPIENT)), and other (containing all other construction types such as incomplete ditransitive sentences and infinitival clauses). Together with the priming conditions, 12 categories were defined – DO(prime)-DO(target), DO-DOshifted, DO-other, DOshifted-DO, DOshifted-DOshifted, DOshifted-other, PO-DO, PO-DOshifted, PO-other, baseline-DO, baseline-DOshifted, and baseline-other. If participants corrected themselves, the final version of the description was scored.

The experiment has a one-way repeated measures design, with the prime condition as independent variable. Every participant saw each of the 24 items in one version, six items in each condition. Every fourth participant saw the same versions of all items. The proportions of the 12 different categories were used as the dependent variable: The quantity of every prime-target pair (e.g., DO-DO) was divided through the total number of descriptions following the accordant prime condition (e.g., DO-DO + DO-DOshifted + DO-other). All proportions were calculated for both participants and items. After arcsine-transforming these proportions, they were used as data for Analyses of Variance (ANOVAs), with tests for both participant as random factor (F1) and item as random factor (F2).

3.2 Results and Discussion

All 24 participants produced a description for each experimental picture so that there were 576 responses and no empty cells. 81.3% of all experimental picture descriptions were DOs, 10.9% DOshifted. The group of other responses (7.8%) consisted of incomplete ditransitive sentences (usually the RECIPIENT was missing), POs (there were two verbs that elicited the use of a reflexive form, which makes the PO construction available), infinitival clauses, and complement clauses. The results are summarised in Table 1:

Table 1: Results experiment 1

	DO	DOshifted	Other
DO	86.1	8.3	5.6
DOshifted	79.9	12.5	7.6
PO	79.2	10.4	10.4
Base	79.9	12.5	7.6

There were numerically more other descriptions following PO primes (10.4%) than following DO (5.6%), DOshifted (7.6%), and baseline primes (7.6%). However, the overall effect of prime on other responses was not significant ($F(3,69) = 1.094, p = .358$; $F(3,69) = 1.703, p = .175$ (Greenhouse-Geisser corrected: $p = .190$)).

There was no significant overall effect of prime, neither for DO descriptions ($F(3,69) = 1.252, p = .298$; $F(3,69) = 1.980, p = .125$), nor for DOshifted descriptions ($F(3,69) = 1.148, p = .336$, $F(3,69) = .619, p = .605$).

Planned contrasts showed that, firstly, the difference between the number of produced DOs following DO primes and the number of produced DOs following DOshifted primes was not significant between participants ($F(1,23) = 2.488, p = .128$) but that is was significant between items ($F(1,23) = 4.487, p = .045$). Secondly, the difference between the number of produced DOshifted descriptions following DOshifted primes and the number of produced Doshifted descriptions following DO primes was neither significant between participants nor between items ($F(1,23) = 2.091, p = .162$, $F(1,23) = 1.295, p = .267$). Finally, not significantly more DOshifted descriptions were produced following PO primes than following DO primes ($F(1,23) = .526, p = .476$; $F(1,23) = .324, p = .575$). Figure 5 shows the effects of the four priming conditions on the number of DOshifted descriptions:

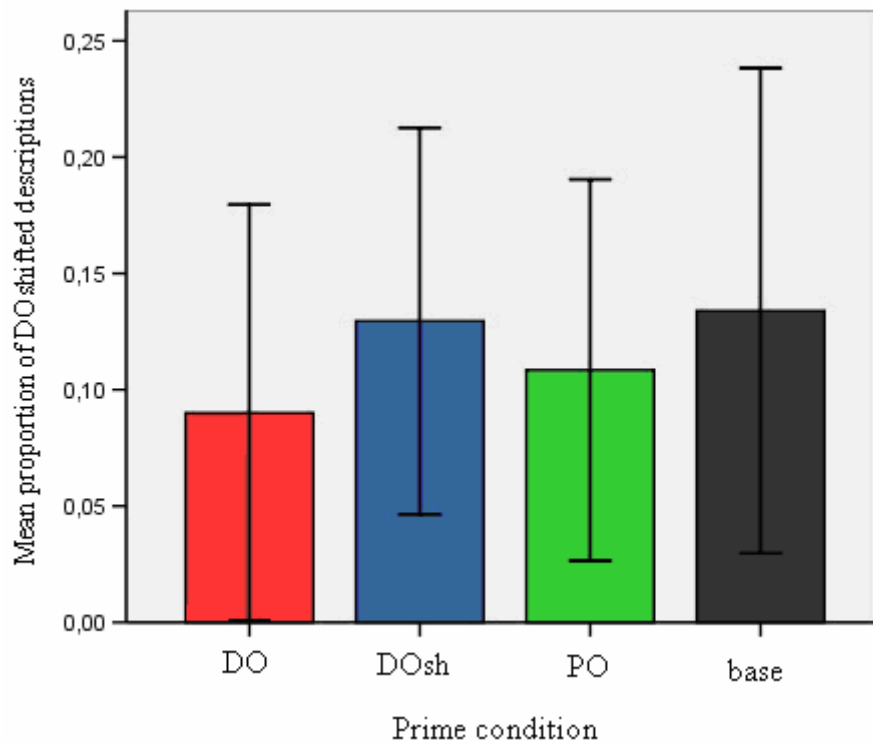


Figure 5: Mean numbers of produced DOshifted descriptions for all four priming condition in Experiment 1 (between participants) (DOsh = DOshifted)

Experiment 1 failed to show priming effects: The difference between DO and DOshifted as primes for DO and the difference between DO and DOshifted as primes for DOshifted showed the expected tendency but were quite weak. That means that the experiment does not support the difference between the two versions of DO and that there was no word order priming. However, it is important to consider that there were only 10.94% DOshifted descriptions in all. The DOshifted construction is in general much less frequently used than DO and often considered as rather marked. This means that the lack of statistical significance of the results does not clearly tell us that there is no psychological difference: The effects might be stronger if there were generally more DOshifted responses.

The results cannot make a clear contribution to the discussion about the stages of functional processing and of hierarchy-only, either: DO and DOshifted did not prime each other but DO did not reliably prime DO and DOshifted did not reliably prime DOshifted, either.

With regard to the expected semantic effect, namely an increase of DOshifted descriptions after PO primes, the trends in this experiment were also in the expected direction but were even weaker than the DO-DOshifted difference. This could be taken as evidence against a semantic effect but again the small number of DOshifted in general should be taken into account.

Since all effects show the expected direction but suffer from a lack of power, a second experiment was conducted, in which the same verbs were used for primes and targets. If the indicated effects are real, the repetition of the verbs should result in a stronger priming effect (Pickering & Branigan, 1998).

4. Experiment 2

The second experiment was designed to strengthen the effects reported in Experiment 1: The same verbs were used for the prime sentences and target pictures. Although the phenomenon of syntactic priming is not due to the lexical content of particular words, priming can be enhanced when the same verb is used for primes and targets, an effect referred to as the *lexical boost* (Pickering & Branigan, 1998). For the design of the second experiment, this means that both prime and target verbs belong to the alternating class. This does not change the rationale; it only results in the addition of another possible outcome construction, namely PO.

The predictions for the second experiment are similar to those of Experiment 1: The priming effect of PO for DOshifted descriptions are predicted to be stronger than the one in the first experiment because of the lexical boost effect. Additionally, there will be a priming effect for DOshifted primes on PO descriptions. DO will prime DO and DOshifted will prime DOshifted more strongly than it was the case in Experiment 1. DO and DOshifted will still not prime each other.

4.1 *Methods*

4.1.1 *Participants.*

36 participants took part in experiment 2, 23 females and 13 males, some of which were students and some of which were professionals in different fields. They were aged 22 to 68 years old, with an average of 31.97 years. Participants were tested in Bochum or Kempen (Northrhine-Westphalia, Germany), among others at the University of Bochum. Participation was voluntary.

4.1.2 *Materials and procedure.*

The materials were very similar to the materials in Experiment 1. The same experimental techniques were used - the sentence-picture-match task for the presentation of the prime sentences and picture descriptions as target task. The prime conditions were the same as well: DO, DOshifted, PO, and baseline (see examples 11). The items for the prime task were equal to those in the first experiment. However, the items for the picture descriptions were modified: Firstly, new verbs were printed under the pictures, such that the verb on the picture was always the same as the verb in the preceding prime sentence. Secondly, some of the characters and objects were changed in order to make the presented states of affairs fit the propositions expressed by the verbs. As in experiment 1, neither characters, nor objects were repeated between primes and targets and the order of presentation of all target pictures was counterbalanced. The fillers were the same as in the first experiment. All experimental sentences are listed in Appendix A. The procedure was exactly the same as in Experiment 1.

4.1.3 *Scoring, design, and data analysis.*

The experiment was recorded on audio tape. The sentences produced in the experimental target picture description were coded in the same way as in the first experiment but using four categories instead of three: DO (V – NP(RECIPIENT) – NP(THEME)), DOshifted (V – NP(THEME) – NP(RECIPIENT)), PO (V – NP(THEME) – PP(RECIPIENT)), and other. Together with the four priming conditions (DO, DOshifted, PO, and baseline), 16 categories were defined. If participants corrected themselves, the final version of the description was scored.

The experiment had the same design as the first experiment. The frequency of the 16 different categories was used as the dependent variable, in particular, again, the proportions of each type (e.g., DO-DO / DO-DO + DO-DOshifted + DO-PO + DO-other). All proportions were calculated for both participants and items and arcsine-transformed. Analyses of Variance (ANOVAS) were performed, with tests for both participant as random factor (F1) and item as random factor (F2).

4.2 Results and Discussion

The results of 32 participants were analysed. The other four participants had to be excluded due to technical problems. No empty cells were produced but one item had to be excluded due to a mistake of the experimenter because the verb was not repeated between prime sentence and target. Hence there were 736 responses. In total, 63.18% of the picture descriptions were DO sentences, 15.38% were DOshifted sentences, 18.07% were PO sentences, and 3.4% were other descriptions. The group of other responses consisted of incomplete ditransitive sentences (missing RECIPIENT), sentences containing auxiliaries, passives, descriptions with the wrong verb, and one POshifted construction. Table 2 shows the results of the second experiment:

Table 2: Results experiment 2

	DO	DOshifted	PO	Other
DO	77.7	11.9	8.7	1.6
DOshifted	63.6	19.0	13.6	3.8
PO	43.5	16.3	35.9	4.4
Base	67.9	14.1	14.1	3.8

The overall difference between the quantity of other responses for the four priming conditions was not significant ($F1(3,93) = .661, p = .578$; $F2(3,66) = .874, p = .459$).

Analyses of variance showed that there was a reliable overall effect of prime for PO (for both participants and items as random factors: $F1(3,93) = 19.807, p < .001$; $F2(3,66) = 21.658, p < .001$) as well as a significant effect for DO as prime (also for both participants and items as random factors: $F1(3,93) = 20.542, p < .001$; $F2(3,66)$

= 15.656, $p < .001$). The overall effect of DOshifted as prime was non-significant ($F(3,93) = 1.547$, $p = .208$; $F(3,66) = 1.546$, $p = .211$).

Planned contrasts showed that there were significantly more DO responses following DO primes than following DOshifted primes ($F(1,31) = 14.322$, $p = .001$; $F(1,22) = 5.794$, $p = .025$). There were also marginally significantly more DOshifted descriptions in the DOshifted prime condition than in the DO condition ($F(1,31) = 3.232$, $p = .082$; $F(1,22) = 3.229$, $p = .086$). PO was a better prime for DOshifted than DO, but this difference was not significant ($F(1,31) = 1.223$, $p = .277$; $F(1,22) = 1.837$, $p = .189$). Likewise, more PO descriptions were produced after DOshifted primes than after DO primes, but this difference was not significant ($F(1,31) = 1.806$, $p = .189$; $F(1,22) = 2.509$, $p = .127$). Figure 6 shows the effect of the four prime types on DOshifted responses.

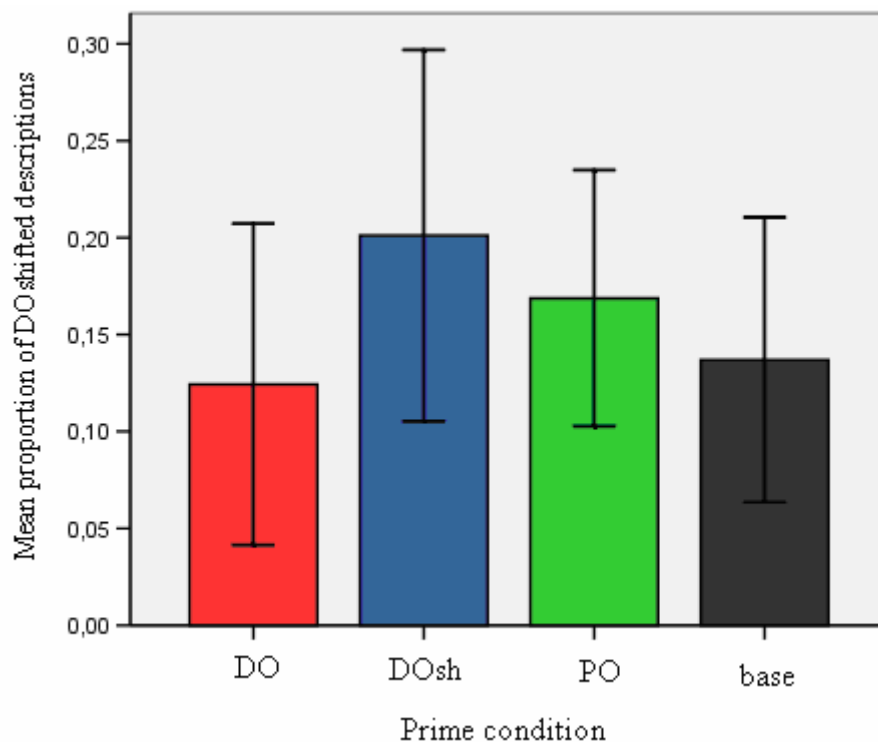


Figure 6: Mean numbers of produced DOshifted descriptions for all four priming conditions in Experiment 2 (between participants) (DOsh = DOshifted)

Experiment 2 provides some clearer results than experiment 1. Firstly, there is convincing evidence that PO and DO in German ditransitive sentences can be primed: PO primes elicit 27.17% more PO descriptions than DO primes (and 21.74% more

than baseline primes) and DO primes elicit 34.42% more DO descriptions than PO primes (and 9.79% more than baseline primes). This is interesting in so far as there has not been much evidence for a reliable priming effect for German ditransitives so far (Loebell & Bock 2003 report a marginal effect of PO priming from English to German). Moreover, this result shows that the design of the experiment worked in general (i.e. that participants actually read the prime sentence etc.).

More importantly, there was the predicted effect of word order within the double object construction: Significantly more DOs were produced in the DO condition than in the DOshifted condition (14.13%) and marginally significantly more DOshifted responses were used in the DOshifted condition than in the DO condition (7.06%). These differences support the hypothesis that the order of phrases within the double object construction matters. However, it is unclear what exactly it is that makes DO and DOshifted psychologically different. I will come back to this question in the general discussion.

The different behaviour of DO and DOshifted could be taken as evidence against independent levels of hierarchy-only and functional processing in grammatical encoding: Within both the hierarchy-only level and functional processing, DO and DOshifted do not differ and should, hence, prime each other. This is apparently not the case. However, as mentioned earlier, the alternative possibility is that there is additional priming on the ‘lower’ or ‘later’ level of word order that can overrule ‘higher’ or ‘earlier’ effects. Within this model, it is possible that priming between DO and DOshifted took place in the current experiments but did not become visible because there was a stronger priming effect of word order. I will come back to this in the general discussion. That the effect was much bigger for DO descriptions might be due to the overall much higher number of DO compared to DOshifted descriptions (47.80% difference) – despite the use of repeated verbs, still, participants showed a strong preference for the DO construction in general.

With regard to semantic effects, the second experiment shows a similar but stronger trend than the first experiment, which supports the prediction: PO has a greater priming effect for DOshifted than DO does. Additionally, this experiment makes it possible to compare the interplay of DOshifted and PO the other way round:

DOshifted works better as a prime for PO than DO. These effects are still rather weak but they indicate that thematic or semantic structure plays a role independently from phrase structure. This effect, however, still does not seem to be strong enough to work against the priming of phrase structure, despite the repetition of the verb.

The only experimental studies so far which have succeeded in finding a semantic effect (thematic roles or animacy) that clearly worked against a phrase structure mismatch were the provide-with investigations (Hare & Goldberg, 1999; Salamoura & Williams, in press) and Bock et al.'s (1992) study. In Chang et al. (2003), the phrase structures of both constructions were the same (NP-PP). Heydel and Murray (2000) reported a priming effect against phrase structure as well – however, an influence of pragmatics is likely. It is an interesting question, why the effects in the provide-with studies were so much stronger. Possibly, the current results suffer from a lack of power due to the high number of possible outcome types (DO, DOshifted, and PO). Finally, Salamoura and William's first argument pairing hypothesis would predict that PO and DOshifted should prime each other – the first postverbal arguments of PO and DOshifted share both the phrasal category (NP) and the thematic role (THEME).

5. General Discussion

The results of the experiments provide some interesting findings and indications. Firstly, DO and DOshifted differ in some regard, which shows that either priming on a dominance-only and functional level does not take place at all or that a stronger effect of word order priming works against it. Secondly, thematic roles or animacy status might play a weak role in syntactic priming as well but this effect is not strong enough to work against opposite syntactic effects (i.e. a phrase structure mismatch between prime and target sentences). However, there are still some important issues that deserve further discussion: Firstly, it is a matter of interest to the current study what the actual psychological difference between different word orders is. Secondly, I will examine which conclusions can be drawn from the current investigation for modelling grammatical encoding.

5.1 *The Psychological Reality of Word Order*

As the priming effects of DO and DOshifted indicate, it seems to be the case that our language production system can be influenced in its choice how to order phrases that are of the same syntactic category (NPs). Where can the priming effect be located? Since the crucial process is linearization, one might say that it is word order priming as established by Hartsuiker and colleagues (Hartsuiker, Kolk, & Huiskamp, 1999; Hartsuiker & Westenberg, 2000). However, as mentioned earlier, Hartsuiker and colleagues do not explicitly say, what they mean by word order. In the case of NP-NP it cannot be the ordering of phrase types or of parts of speech (neither the ordering of the lexical words themselves). Apparently then, other information that differentiates DO from DOshifted must be relevant for the priming effect. There are several possible characteristics of both constructions (as used in this study) that could be crucial (Table 3):

Table 3: Linguistic differences between DO and DOshifted

	DO	DOshifted
Case	dative – accusative	accusative – dative
Grammatical functions	indirect object – direct object	direct object – prepositional (indirect) object
Abstract syntactic structure	canonical word order	marked word order (e.g., via movement)
Conceptual features	animate – inanimate	inanimate – animate
Thematic roles	recipient – theme	theme – recipient
Pragmatics	no special emphasis	slight emphasis on the recipient

How likely is it for the different factors to be crucial for priming? There are some findings from corpus studies that could help to solve this problem in that they show which features of the objects play a role in their ordering. Audehm (2006) analysed the word order in the German Mittelfeld using two corpora of spoken German. She found out that, first of all, dative objects most often precede accusative objects in ditransitive sentences of the V-NP-NP type (91.43% of all occurrences in the first corpus, 81.81% in the second corpus). This strong tendency has become very obvious in

the production data of both experiments discussed above (of all DO responses together with DOshifted responses, 80.45% were DO in Experiment 2). There are different factors that lead to this phenomenon: Firstly, the accusative object usually refers to the referent which is *new*, that means that the referent has not been established in the prior context (there is a general tendency to mention old information before new information). Secondly, the referent of the accusative object is usually less animate than the referent of the dative object (there is another general tendency to mention animate referents before inanimate referents). Thirdly, the dative object has a stronger tendency to be pronominal than the accusative object (there is a third tendency for pronouns to precede other NPs). To sum up, the three factors givenness (or newness), animacy, and pronominalisation have been shown to influence the ordering of the object NPs in DO sentences in German.

There have been similar attempts to predict the dative alternation in English. Beside animacy, pronominality, and discourse accessibility, factors such as length (or heaviness) and definiteness have been suggested to be relevant. Bresnan et al. (2004), for instance, found out that all five constraints (discourse given before discourse new, pronoun before nonpronoun, animate before inanimate, definite before indefinite, and short before long) make a significant prediction (together with verb bias they predict the choice of construction with 94 % accuracy).

Of course, this kind of corpus study does not tell us anything about priming. However, such studies show which factors are relevant for syntactic choices in language production and it makes sense to assume that the same factors could play a role in priming as well. With regard to the current study, pronominalisation, definiteness, and discourse givenness cannot be crucial factors – only nonpronominal definite NPs were shown in the prime sentences and there was no surrounding discourse context. It is also unlikely that the relative length of the NPs played a role since the length of nouns that were most likely to be used for the picture descriptions was controlled for. However, it is possible that the order of the animate and inanimate NPs was primed (or the order of thematic roles since both factors are not disentangled in the experimental items) and given that there was a tendency of semantic structure priming independent of phrase structure (that PO and DOshifted primed each other), this possibility seems to be plausible.

If this is true, however, it is also clear that more than one linguistic factor must be relevant for differentiating between different word orders. The ordering of animacy cannot, for example, be an explanation for the priming effect that Hartsuiker and colleagues (Hartsuiker, Kolk, & Huiskamp, 1999; Hartsuiker & Westenberg, 2000) found (V-AUX versus AUX-V). In this case, the ordering of parts of speech could be the origin. To sum up, there does not seem to be a single factor that can account for all different types of word order priming. For the present study, animacy is a likely candidate. However, further investigations are necessary to really decide between all possible factors, such as those presented in Table 3.

Another problem that arises when speaking about word order priming is that we do not really know whether the primed information is really the mere ordering of particular items (such as V and AUX, Hartsuiker & Westenberg 2000), independent from the rest of the sentence, or, rather, the association or linking of these items to particular positions in the sentence. Positions could be really abstract specific positions (such as SpecI) or positions relative to all or some other parts of the sentence (e.g., between the verb and the direct object). For the former assumption, it would not matter which and how many other words or phrases there are in the prime and target sentences; in principle, the structure of the sentence as a whole should not matter. For Hartsuiker et al. (1999), for example, the question would be that of deciding whether it is important which absolute position the PP is linked to or if it only matters whether the PP precedes or follows the verb:

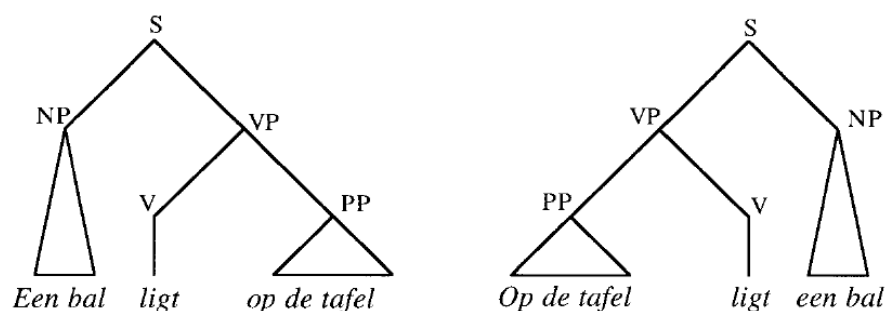


Figure 7: Structure trees for a PP-initial and a PP-final example sentence (Hartsuiker et. al, 1999, p. 136)

One could try to disentangle these alternatives by changing the structures of prime and target sentences, for instance, by embedding the crucial items or by inserting different intervening words or phrases.

Finally, instead of thinking in terms of word order priming, one could assume that the priming effect of DO for DO and DOshifted for DOshifted is located at a more general level of construction type on which there would be a three way distinction between PO, DO and DOshifted. This would more or less include the combination of the functional and positional level and there would be only one point of choice, the choice between complex constructions. In the model of Pickering and Branigan (1998), for example, each verb lemma is linked to one or more combinatorial node(s), which determine the combination of phrases that are possible objects for the verb (e.g., NP-PP and NP-NP for *give*). Based on their study, Pickering et al. (2002) assume that there are actually three different combinatorial nodes for English ditransitive verb lemmas, NP-PP, NP-NP, and PP-NP. However, when transferring this to the German data of the current study, the three nodes would be NP-PP, NP₁-NP₂, NP₂-NP₁. It then becomes obvious that there is still the problem to define which linguistic features are relevant (i.e. what the indices stand for).

5.2 *Implications for a Model of Grammatical Encoding*

One problem that has become obvious in this investigation is that of deciding at which stages in grammatical encoding priming effects take place. The current results together with those of other studies (Hartsuiker & Westenberg, 2000; Pickering et al., 2002, Bernolet et al., in preparation) could be interpreted as evidence against both a level of functional processing and a hierarchy-only stage. However, as mentioned earlier, it could also well be that effects on different levels add up and can overrule each other.

One aspect that supports the hypothesis that functional processing cannot be primed (because it does not exist in the way it is usually defined) is that it is problematic to provide the assignment of grammatical functions with such a central role. Crosslinguistically, concepts like subject and object are not always easily applicable (e.g., Givon, 1997; Dryer, 1997, Van Valin & LaPolla, 1997). The Austronesian lan-

guage Acehnese, for instance, does not have grammatical functions that can be defined purely grammatically (morphosyntactically) (Van Valin & LaPolla, 1997). Of course, it is another debate how exactly grammatical functions should be defined.

With regard to a hierarchy-only level, it should be asked how much sense the order makes in which decisions are supposed to be made by the language production system. How intuitive is it that there should be a separate step at which decisions about alternatives such as DO versus PO are made that precedes the linearization of word order? In fact, it seems a bit arbitrary to assign the construction itself such a high importance instead of considering it, in the same way as word order, and that is as just a way to fulfil other decisions or constraints (such as animate before inanimate, given before new, pronominal before nominal and so forth). This critique is backed up by the fact that there are only a really small number of real syntactic alternations. Most of the time, there is not really more than one syntactic frame left after other conceptual-semantic decisions about the message, the speech situation, the context, and so forth have been made. It would then make sense to assume that construction type (e.g., DO or PO) and word order (e.g., NP1-NP2 or NP2-NP1) are determined at the same step, together with or shortly before the assignment of inflections and the insertion of function words. This hypothetical model might seem underspecified for some cases, such as German ditransitives, where there could be two steps for decisions (construction type and word order). However, in most cases, there is either only a choice of word order or a choice of construction, if any. There is therefore no a priori reason not to have both kinds of decisions at one and the same level. This idea would also fit into a construction grammar account, in which a specific word order counts as an abstract construction as well (e.g., Kuningas & Leino, 2006) so that word order and constructions like PO and DO can be treated alike.

In this sense, there are at least logical arguments for the hypothesis that priming at a functional and a hierarchy-only level does not take place at all rather than that it is overridden by later (word order) effects.

6. Conclusion

This investigation has made some contributions to the discussion about the nature of syntactic priming. Firstly, the current experimental findings together with results of previous studies indicate that a weak influence of semantic information (thematic roles or animacy) is likely. Secondly, the results show that the order of two phrases of the same syntactic category (NP) can be primed. The crucial features that differentiate between the two phrases remains unclear, however. Animacy possibly plays a role. Finally, the findings are compatible with a model of grammatical encoding with neither a functional nor a hierarchy-only stage as well as with a model in which priming effects on different levels are cumulative and can overrule each other.

Appendix A. Experimental items in Experiment 1 and 2

All prime sentences were presented in all four conditions. In the following list of experimental items, the first line shows the first part of the prime sentence that is common to the DO, DOshifted, and PO condition, the second line shows the second part of the DO prime sentence, the third line shows the second part of the DOshifted prime sentence, and the fourth line shows the second part of the PO prime sentence. The fifth line contains the baseline prime sentence. The sixth line describes the corresponding target picture in Experiment 1, line seven the target picture in Experiment 2.

1. Die Krankenschwester übergibt (The nurse passes)
 dem Clown die Tasse. (the clown the cup.)
 die Tasse dem Clown. (the cup the clown.)
 die Tasse an den Clown. (the cup to the clown.)
 Die Krankenschwester rennt. (The nurse runs.)
 PICTURE 1: pirate gives seaman banana (verb: *schenken* ‘to give’)
 PICTURE 2: pirate passes seaman banana (verb: *übergeben* ‘to pass’)

2. Die Nonne übergibt (The nurse passes)
 dem Maler das Buch (the painter the book.)
 das Buch dem Maler. (the book the painter.)
 das Buch an den Maler. (the book to the painter.)
 Der Ritter klatscht. (The knight claps.)
 PICTURE 1: nurse shows doctor comb (verb: *zeigen* ‘to show’)
 PICTURE 2: nurse passes doctor comb (verb: *übergeben* ‘to pass’)

3. Der Polizist liefert (The policeman delivers)
 dem Soldaten den Apfel. (the soldier the apple.)
 den Apfel dem Soldaten. (the apple the soldier.)
 den Apfel an den Soldaten. (the apple to the soldier.)
 Der Matrose rennt. (The seaman runs.)
 PICTURE 1: cook shows boxer scissors (verb: *zeigen* ‘to show’)
 PICTURE 2: cook delivers pear to boxer (verb: *liefern* ‘deliver’)

4. Der Pirat liefert (The pirate delivers)
dem Arzt den Ball. (the doctor the ball.)
den Ball dem Arzt. (the ball the doctor.)
den Ball an den Arzt. (the ball to the doctors.)
Der Arzt schwitzt. (The doctor sweats.)
PICTURE 1: clown gives cowboy hammer (verb: *schenken* 'to give')
PICTURE 2: clown delivers hammer to cowboy (verb: *liefern* 'to deliver')

5. Die Nonne schickt (The nun sends)
dem Schwimmer den Brief. (the swimmer the letter.)
den Brief dem Schwimmer. (the letter the swimmer.)
den Brief an den Schwimmer. (the letter to the swimmer.)
Der Skifahrer springt Seil. (The skier jumps rope.)
PICTURE 1: pirate presents book to clown (verb: *präsentieren* 'to present')
PICTURE 2: pirate sends clown book (verb: *schicken* 'to send')

6. Der Taucher schickt (The diver sends)
dem Soldaten den Brief. (the soldier the letter.)
den Brief dem Soldaten. (the letter the soldier.)
den Brief an den Soldaten. (the letter to the soldier.)
Der Taucher klatscht. (The diver claps.)
PICTURE 1: painter lends boxer keys (verb: *leihen* 'to lend')
PICTURE 2: paper sends boxer newspaper (verb: *schicken* 'to send')

7. Der Arzt überbringt (The doctor delivers)
dem Boxer die Torte. (the boxer the torte.)
die Torte dem Boxer. (the torte the boxer.)
die Torte an den Boxer. (the torte to the boxer.)
Der Clown lacht. (The clown laughs.)
PICTURE 1: painter lends diver scissors (verb: *leihen* 'to lend')
PICTURE 2: painter delivers scissors to diver (verb: *überbringen* 'to deliver')

8. Der Clown überbringt (The clown delivers)
dem Koch den Hut. (the cook the hut.)

den Hut dem Koch. (the hut the cook.)

den Hut an den Koch. (the hut to the cook.)

Der Arzt weint. (The doctor cries.)

PICTURE 1: painter presents flower to boxer (verb: *präsentieren* 'to present')

PICTURE 2: painter delivers flower to boxer (verb: *überbringen* 'to deliver')

9. Der Koch vermietet (The cook rents)

dem Arzt die Pistole. (the doctor the gun.)

die Pistole dem Arzt. (the gun the doctor.)

die Pistole an den Arzt. (the gun to the doctor.)

Der Taucher gähnt.

PICTURE 1: pirate promises swimmer pear (verb: *versprechen* 'to promise')

PICTURE 2: pirate rents swimmer scissors (verb: *vermieten* 'to rent')

10. Der Dieb vermietet (The thief rents)

dem Arzt die Pistole. (the doctor the gun.)

die Pistole dem Arzt. (the gun the doctor.)

die Pistole an den Arzt. (the gun to the doctor.)

Der Dieb raucht. (The thief smokes.)

PICTURE 1: nurse gives diver keys (verb: *verschaffen* 'to get')

PICTURE 2: nurse rents diver keys (verb: *vermieten* 'to rent')

11. Der Lehrer verkauft (The teacher sells)

dem Cowboy den Krug. (the cowboy the mug.)

den Krug dem Cowboy. (the mug the cowboy.)

den Krug an den Cowboy. (the mug to the cowboy.)

Der Dieb schimpft. (The thief blusters.)

PICTURE 1: pirate brings doctor comb (verb: *verschaffen* 'to get')

PICTURE 2: pirate sells doctor comb (verb: *verkaufen* 'to sell')

12. Die Ballerina verkauft (The ballerina sells)

dem Schwimmer die Torte. (the swimmer the torte.)

die Torte dem Schwimmer. (the torte the swimmer.)

die Torte an den Schwimmer. (the torte to the swimmer.)

Der Skifahrer weint. (The skier cries.)

PICTURE 1: nurse promises boxer keys (verb: *versprechen* 'to promise')

PICTURE 2: nurse sells boxer flower (verb: *verkaufen* 'to sell')

13. Der Dieb reicht (The thief hands)

dem Matrosen das Buch. (the seaman the book.)

das Buch dem Matrosen. (the book the seaman.)

das Buch an den Matrosen. (the book to the seaman.)

Der Dieb fällt. (The thief falls.)

PICTURE 1: teacher lends soldier gun (verb: *borgen* 'to lend')

PICTURE 2: teacher hands soldier gun (verb: *reichen* 'to hand')

14. Der Mönch reicht (The monk hands)

Dem Soldaten das Buch. (the soldier the book.)

das Buch dem Soldaten. (the book the soldier.)

das Buch an den Soldaten. (the book to the soldier.)

Der Mönch rennt. (The monk runs.)

PICTURE 1: nurse recommends pear to boxer (verb: *empfehlen* 'to recommend')

PICTURE 2: nurse hands boxer pear (verb: *reichen* 'to hand')

15. Der Indianer sendet (The indians sends)

dem Schwimmer das Paket. (the swimmer the parcel.)

das Paket dem Schwimmer. (the parcel the swimmer.)

das Paket an den Schwimmer. (the parcel to the swimmer.)

Der Boxer rennt. (The boxer runs.)

PICTURE 1: nurse recommends pot to doctor (verb: *empfehlen* 'to recommend')

PICTURE 2: nurse sends doctor book (verb: *senden* 'to send')

16. Der Boxer sendet (The boxer sends)

der Ballerina die Zeitung. (the ballerina the newspaper.)

die Zeitung der Ballerina. (the newspaper the ballerina.)

die Zeitung an die Ballerina. (the newspaper to the ballerina.)

Der Indianer weint. (The indian cries.)

PICTURE 1: painter lends doctor ball (verb: *borgen* ‘to lend’)

PICTURE 2: painter sends doctor book (verb: *senden* ‘to send’)

17. Der Mönch überreicht (The monk hands)

der Krankenschwester die Pistole. (the nurse the gun.)

die Pistole der Krankenschwester. (the gun the nurse.)

die Pistole an die Krankenschwester. (the gun to the nurse.)

Der Mönch fällt. (The monk falls.)

PICTURE 1: policeman explains book to clown (verb: *erklären* ‘to explain’)

PICTURE 2: policeman hands clown ball (verb: *überreichen* ‘to hand’)

18. Der Mönch überreicht (The monk hands)

den Cowboy den Hut. (the cowboy the hut.)

den Hut den Cowboy. (the hut the cowboy.)

den Hut an den Cowboy. (the hut to the cowboy.)

Der Mönch läuft. (The monk walks.)

PICTURE 1: policemen discloses gun to soldier (verb: *offenbaren* ‘to disclose’)

[item excluded in Experiment 2]

19. Der Skifahrer überlässt (The skier leaves)

der Krankenschwester den Krug. (the nurse the mug.)

den Krug der Krankenschwester. (the mug the nurse.)

den Krug an die Krankenschwester. (the mug to the nurse.)

Der Mönch schläft. (The monk sleeps.)

PICTURE 1: teacher discloses keys to boxer (verb: *offenbaren* ‘to disclose’)

PICTURE 2: teacher leaves boxer keys (verb: *überlassen* ‘to leave’)

20. Der Indianer überlässt (The policeman leaves)

dem Boxer den Apfel. (the boxer the apple.)

den Apfel dem Boxer. (the apple the boxer.)

den Apfel an den Boxer. (the apple to the boxer.)

Der Ritter schläft. (The knight sleeps.)

PICTURE 1: soldier explains book to cook (verb: *erklären* 'to explain')

PICTURE 2: soldier leaves cook book (verb: *überlassen* 'to leave')

21. Die Krankenschwester vermacht (The nurse bequeathes)

dem Clown den Schlüssel. (the clown the keys.)

den Schlüssel dem Clown. (the keys the clown.)

den Schlüssel an den Clown. (the keys to the clown.)

Der Ritter niest. (The knight sneezes.)

PICTURE 1: policemen forbid pirate gun (verb: *verbieten* 'to forbid')

PICTURE 2: policemen bequeathes gun to pirate (verb: *vermachen* 'to bequeath')

22. Der Koch vermacht (The cook bequeathes)

dem Taucher den Hammer. (the diver the hammer.)

den Hammer dem Taucher. (the hammer the diver.)

den Hammer an den Taucher. (the hammer to the diver.)

Der Koch schießt. (The cook shoots.)

PICTURE 1: policemen grants soldier banana (verb: *gönnen* 'to grant')

PICTURE 2: policeman bequeathes banana to soldier (verb: *vermachen* 'to bequeath')

23. Der Polizist überträgt (The policeman transfer)

dem Clown das Buch. (the clown the book.)

das Buch dem Clown. (the book the clown.)

das Buch an den Clown. (the book to the clown.)

Der Taucher lacht. (The diver laughs.)

PICTURE 1: teacher grants boxer flower (verb: *gönnen* 'to grant')

PICTURE 2: teacher transfers boxer keys (verb: *übertragen* 'to transfer')

24. Der Lehrer überträgt (The teacher transfers)

dem Ritter die Banane. (the knight the banana.)

die Banane dem Ritter. (the banana the knight.)

die Banane an den Ritter. (the banana to the knight.)

Der Skifahrer niest. (The skier sneezes.)

PICTURE 1: policemen forbid soldier gun (verb: *verbieten* ‘forbid’)

PICTURE 2: policeman transfer gun to soldier (verb: *übertragen* ‘to transfer’)

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Glossary

acc	accusative
dat	dative
fem	feminine
masc	masculine
nom	nominative
sg	singular